

# Searching for the Sustainably Profitable Stocks: Evidence on S&P 500 Companies

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Received: December 30, 2016

Accepted: January 18, 2017

Online Published: January 23, 2017

doi:10.5430/afr.v6n1p89

URL: <http://dx.doi.org/10.5430/afr.v6n1p89>

## Abstract

Using a balanced panel dataset of 214 firms from S&P 500 during 2001-2012, the main purpose of this study is to search for the possibility of the sustainably profitable stocks by utilizing a nonlinear panel smooth transition regression (PSTR) model. We document three important empirical findings on this study. First, we show that the concurrent total asset growth rate and the change in EPS positively correlate with the market adjusted stock returns, while one-year lagged market-to-book asset ratio (MBA) had negative impact on market adjusted stock returns. Second, we find that most value stocks remained in the same regime over the sample period and the annual average market-adjusted return of these value stocks is 7.80%, approximately 10.56% higher than growth stocks. Third, we further report that 116 valued firms in our sample are most likely to be sustainably profitable stocks over the entire sample period and the annual average market-adjusted return of these stocks is 6.53%. Especially now, with an investment environment that has been somewhat ungenerous in offering returns, we expect these interesting findings provide rich implications for institutional investors to design profitable and effective investment strategies.

**Keywords:** Market-adjusted stock return, Change in EPS, Total asset growth rate, Market-to-book asset ratio, Market equity, Investment opportunity

## 1. Introduction

Financial economists and practitioners have often investigated a fundamental question in finance that is how a firm's past stock performance affects future stock return. It is interesting to note that early studies find less evidence of significant autocorrelations in stock returns and usually conclude that the random walk model is a good specification to test stock price data. Consequently, it has been a support for the efficient market hypothesis (e.g., Fama, 1970).

A growing body of literature, however, has argued this point by using alternative statistical measures and demonstrating empirical evidence of significant autocorrelations of stock returns. (e.g., Keim and Stambaugh, 1986; Fama and French, 1988; Poterba and Summers, 1988). In particular, several studies conclude that there exist strong positive autocorrelations in short-term period of common stock returns (e.g., Lo and MacKinlay, 1988; and Conrad and Kaul, 1988) but negative autocorrelations in long-term period. (e.g., Daniel, Hirshleifer and Subrahmanyam, 1998; and Barberies, Shleifer and Vishny, 1998). Specifically, Daniel et al. report that investor overconfidence and biased self-attribution can explain this anomaly in the stock market. In their model, investors initially overreact to their private information as they are overconfident about their ability and such continuing overreaction to private information causes momentum in the short-term. The overreaction in stock prices will eventually be corrected in the long-term as investors observe further news and realize their errors. Hence, increased overconfidence results in short-run momentum and long-run reversal. On one hand, Jegadeesh and Titman (1993) find that momentum trading strategy which is long in recent winner stocks and short in recent loser stocks earns positive excess returns over horizons of 3-12 months. On the other hand, some empirical literature also documents the phenomenon of long-term reversal in stock returns, suggesting the stocks perform poorly in the past outperform the stocks perform well in the past over the next 3-5years. (e.g., DeBondt and Thaler, 1985).

Despite previous literature has shown the significant mean revision in long-horizon portfolio returns, some studies have challenged this view by using different but relevant statistical tests or distribution assumption to present less significant negative serial autocorrelations in long-horizon returns. The main motivation of this research is to explore

the possibility of sustainably profitable stocks by using a nonlinear panel smooth transition regression (PSTR) model. To the best of my knowledge, there is less literature to address this important and interesting issue. The hypothesis that stock returns exhibit long-run positive movement tendency, provided it is true, has far-reaching implication for professional institutional investors because they could create effective and successful investment strategy.

In order to test our research hypothesis described above, we propose an annual market-adjusted stock return ( $MAR_{it}$ ) as a function of three accounting-related variables. The first one is the change in EPS ( $DEPS_{it}$ ), which is a profitability-related proxy variable for the change in profitability after conducting investment opportunity. The second one is the total asset growth rate ( $TAG_{it}$ ), which is a scale-related proxy variable after implementing the investment opportunity through expansion or contraction. The third one is the log-transformed 1-year lagged market-to-book asset ratio ( $LMB_{i,t-1}$ ), which is a growth-related proxy variable for the level of investment opportunities. Additionally, as proposed by González et al. (2005), our study also include a transitional variable for use in a nonlinear panel smooth transition regression (PSTR) model. This transitional variable is the log-transformed 1-year lagged market equity ( $LME_{i,t-1}$ ), which is a scale-related proxy variable for the level of the market equity value in place.

The rest of this paper is as follows. Section 2 depicts both the Fisher Phillips-Perron panel unit root test and the primary structure of PSTR model we apply in this research. Section 3 describes the Data and variable selection. Section 4 presents our main empirical results of PSTR model. Section 5 concludes.

## 2. Methods

### 2.1 Fisher Phillips-Perron Panel Unit Root test

In order to make sure all variables in the panel of this study are stationary before exercising the PSTR model, we initially execute the Fisher Phillips-Perron (PP) panel unit root test that was developed by Maddala and Wu (1999) and Choi (2001). Unlike the Im, Pesaran, and Shin (IPS) test, which is a parametric and asymptotic test, Fisher PP test is a nonparametric and exact test. According to the null of a unit for all cross-sections, if we denote  $\pi_i$  as the  $\rho$  value in any individual unit root test, the asymptotic result can be described as the following equation:

$$Z = \frac{1}{\sqrt{N}} \sum_{i=1}^N \Phi^{-1}(\pi_i) \rightarrow N(0,1) \quad (1)$$

Where  $\Phi^{-1}$  is the inverse of the standard normal cumulative distribution function. The Monte-Carlo studies completed by Maddala and Wu (1999) suggested that the Fisher PP test is much more powerful than IPS test.

### 2.2 Panel Smooth Transition Regression Model

The PSTR model, proposed by González et al. (2005), is considered as the most recent extension STR model on panel data with heterogeneity among the panel members and throughout time. The underlying PSTR model is consisted of a single transition function and two extreme regimes that can be described as follow:

$$y_{it} = \mu_i + \beta'_0 X_{it} + \beta'_1 X_{it} g(q_{it}; \gamma, C) + \varepsilon_{it} \quad (2)$$

where  $i = 1, \dots, N$ ,  $t = 1, \dots, T$ . Specifically,  $N$  and  $T$  present the cross-section and time dimensions of the panel, respectively. The dependent variable  $y_{it}$  is a scalar;  $\mu_i$  means the fixed individual effect;  $X_{it}$  is a  $k$ -dimensional vector of time-varying exogenous variables; and  $\varepsilon_{it}$  is the residual term. The transition function  $g(q_{it}; \gamma, C)$ , a continuous function of the observable variable  $q_{it}$ , is normalized to be bounded between 0 and 1; these extreme values are associated with regression coefficients  $\beta'_0$  and  $\beta'_0 + \beta'_1$ . The values of  $q_{it}$  determine the values of  $g(q_{it}; \gamma, C)$ , and thus the effective regression coefficients are  $\beta'_0 + \beta'_1 g(q_{it}; \gamma, C)$  for individual  $i$  at time  $t$ . Following the method proposed by Granger and Teräsvirta (1993), Teräsvirta (1994), and Jansen and Teräsvirta (1996), we expressed the transition function as follows:

$$g(q_{it}; \gamma, C) = \left(1 + \exp(-\gamma \prod_{j=1}^m (q_{it} - c_j))\right)^{-1} \text{ with } \gamma > 0 \text{ and } C_1 \leq C_2 \leq \dots \leq C_m \quad (3)$$

where  $C = (C_1, \dots, C_m)$  is an  $m$ -dimension vector of location parameters and the slope parameter  $\gamma$  determines the smoothness of the transition. In general, considering  $m=1$  or  $m=2$  is sufficient, because these values allow for typically encountered variations in the parameters. In the case of  $m=1$ , the model identifies that the two extreme regimes are associated with low and high values of  $q_{it}$  and that a single monotonic transition of the coefficients exists from  $\beta'_0$  to  $\beta'_0 + \beta'_1$  as  $q_{it}$  increases, such that the change is centered near  $C_1$ . In the case of  $m=2$ , the minimum of the transition function is at  $(C_1 + C_2)/2$  and achieves the value one at the low and high values of  $q_{it}$ . When  $\gamma$  approaches infinity, the PSTR model reduces to a three-regime panel threshold regression PTR model the outer regimes of which are identical to each other but different from the middle regime.

The multi-level PSTR model is a generalized PSTR model that allows for more than two different regimes; it can be expressed as follows:

$$y_{it} = \mu_i + \beta'_0 X_{it} + \sum_{j=1}^r \beta'_1 X_{it} g_j(q_{it}^j; \gamma_j, c_j) + \varepsilon_{it} \quad (4)$$

where the transition function  $g_j(q_{it}^j; \gamma_j, c_j)$ ,  $j=1, \dots, r$  depend in the slope parameters  $\gamma_j$  and on the location parameters  $c_j$ . If  $r = 1$ ,  $q_{it}^1 = q_{it}$ , and  $\gamma_j \rightarrow \infty$  for all  $j=1, \dots, r$ , the transition function becomes an indicator function, in which  $I[A] = 1$  when event A occurs, and  $I[A] = 0$  otherwise; the model in Eq. (4) becomes a PTR model with  $r + 1$  regimes. Consequently, the multilevel PSTR model is a generalization of the multiple regime PTR denoted by Hansen (1999).

### 2.3 Building the Panel Smooth Transition Regression Model

Building the panel smooth transition regression model requires three stages, such as specification, estimation, and evaluation. Specification stage includes testing for homogeneity, and choosing the transition variable  $q_{it}$ . If the testing fails to exhibit homogeneity, specification covers determining the appropriate form of the transition function; this form is described by the value of  $m$  in Eq. (3). A nonlinear least square method is used to estimate parameters. On estimation stage, the estimated model is restricted to misspecification tests to determine whether adequate data description is provided. The null hypotheses tested in this stage contain parameter constancy, absence of remaining heterogeneity, and absence of autocorrelation among the errors. On last stage, the number of regimes in the panel must be specified, implying that a value have to be assigned to  $r$  in Eq. (4).

## 3. Data and Variable Introduction

### 3.1 Data Selection

As suggested by Hansen (1999), we utilize a balanced panel that composed of 214 firms from S&P 500 companies during 2001-2012. We download firm level data from Compustat, and then remove samples that are unable to meet several standard criteria. First, firms related to Finance, Insurance, and Real Estate are eliminated because it is difficult to tell the operating and finance activities for these firms. Second, firms must end the fiscal year in December, so that the accounting variables among the firms could be aligned. Because most of firms closed the fiscal year in December, this selection requirement did not cause bias in the representativeness of the sample. Other researchers, such as Vuolteenaho (2002), also employ this criterion to do research. Moreover, we also take away the firms without sufficient data or negative book equity in Compustat to calculate the principle accounting factors for the model. Last, firms that experienced fiscal year changes are also eliminated. Based on the aforementioned requirements, the final sample consists of 214 firm observations from 2001 to 2012.

### 3.2 Variable Introduction

#### 3.2.1 Independent Variables

This section discusses three main independent variables we employed in this research. First, total asset growth rate (TAG) is scale-related proxy variable which gauges the annual total asset growth rate after implementing the investment opportunities through expansion, contraction, or abandonment. Second, the change in EPS (DEPS) is a profitability-related proxy variable that presents the difference in expectation for firms' profitability after exercising investment opportunity. If firms, on average, conduct the positive NPV projects, the coefficients of the total asset growth rate (TAG) and the change in EPS (DEPS) in our primary model are expected to be positive. Third, the log-transformed 1-year lagged market to book asset ratio (LMBA) is a current growth-related proxy variable that stands for firm's growth opportunities in our PSTR model. We predict that coefficient of this current growth-related proxy variable is to be negative; that is because LMBA should decrease when growth firms do not retain profitable but increase when value firms turn into profitable. In other words, we determine whether the convergence in the LMBA was resulted largely from the effect of mean reversion in growth, profitability, and expected return.

#### 3.2.2 Dependent Variable

The market-adjusted stock return is the primary independent variable in our research. Specifically, individual market-adjusted stock return is be measured by the individual stock return minus its same-sized market index return.

#### 3.2.3 Transition variable

In this study, we utilize the log-transformed 1-year lagged market equity as a transition variable that stands for the level of market equity in place in our PSTR model. All of four major variables applied in this research are built from the Compustat annual data and also denoted as follows: Time  $t$  presents the fiscal year ending in calendar year  $t$ . In

order to align the accounting variables of all samples, the firms in our sample must close the fiscal year in December. In addition, the log in the following defines natural logarithm.

1.  $MAR_t$  (Market-adjusted stock return, t) =  $[\log(\text{price}(\text{item } 199, t)) - \log(\text{price}(\text{item } 199, t-1))] - [\log(\text{S\&P } 500 \text{ Index}, t) - \log(\text{S\&P } 500 \text{ index}, t-1)]$
2.  $DEPS_t$  (Change in EPS, t) = earnings per share (item 58, t) – earnings per share (item 58, t-1)
3.  $TAG_t$  (Total asset growth rate, t) =  $\log[\text{total assets}(\text{item } 6, t)] - \log[\text{total asset}(\text{item } 6, t-1)]$
4.  $LMBA_{t-1}$  (Log-transformed market to book asset ratio, t-1) =  $\log[(\text{shares price}(\text{item } 199, t-1) \times \text{shares outstanding}(\text{item } 25, t-1) + \text{preferred stock}(\text{item } 10, t-1) + \text{debt in current liabilities}(\text{item } 34, t-1) + \text{long-term debt}(\text{item } 9, t-1) - \text{deferred taxes and investment tax credit}(\text{item } 35, t-1)) / \text{book value of assets}(\text{item } 6, t-1)]$ .
5.  $LME_{t-1}$  (Log-transformed market equity, t-1) =  $\log[\text{shares outstanding}(\text{item } 25, t-1) \times \text{price-fiscal year-close}(\text{item } 199, t-1)]$ .

Table 1 outlines the longitudinal statistics for each major variable in our study. From the table, we observe that all annual means of total asset growth rate (TAG) and change in EPS (DEPS) are both positive numbers which consistent with our idea that if firms, on average, efficiently implement positive NPV projects, the change in profitability (DEPS) and total asset growth rate (TAG) should be positive. In addition, all annual means of market adjusted returns and market equity were 4.92% and \$24,337 M, respectively.

Table 1. Longitudinal descriptive statistics on S&P 500 (214 firms)

Variables	Market adj. return, %		Total asset growth, %		Change in EPS, \$		Market to book asset ratio		Market equity, \$M	
	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.	Mean	Std.
2001	8.46	36.09	11.49	30.84	-0.30	2.08	2.36	2.65	23,961	54,650
2002	9.35	36.26	8.50	23.52	-0.20	2.40	1.93	1.72	21,765	48,657
2003	4.23	26.35	10.80	19.19	0.47	2.82	1.53	1.13	17,372	35,448
2004	9.81	21.28	9.95	14.36	0.52	1.93	1.75	1.43	21,894	43,551
2005	10.05	26.23	10.67	19.12	0.46	1.21	1.79	1.38	23,815	45,859
2006	-0.78	18.67	11.25	20.93	0.37	1.37	1.84	1.40	24,704	44,661
2007	8.03	28.04	10.77	19.05	0.19	1.58	1.80	1.28	28,136	52,145
2008	2.06	35.88	3.51	19.21	-0.96	4.41	1.84	1.37	31,149	56,597
2009	5.01	25.05	6.51	15.76	0.09	4.03	1.25	0.93	20,431	39,617
2010	3.88	20.96	9.70	17.09	0.78	2.06	1.42	0.96	23,847	38,851
2011	-0.87	22.46	9.07	17.71	0.24	1.99	1.49	0.99	27,184	43,099
2012	-0.25	20.60	8.85	16.90	-0.06	2.55	1.39	0.98	27,781	46,271
ALL	4.92	27.43	9.25	19.98	0.13	2.58	1.70	1.45	24,337	46,236

## 4. Empirical Results

### 4.1 Panel Unit Root Tests

The panel smooth transition regression (*PSTR*) model proposed by González et al. (2005) requires that all variables in the model should be stationary to avoid the problems of spurious regressions. Therefore, we conduct the unit root tests to secure all variables are stationary. In addition, Maddala and Wu (1999) indicate that the Fisher PP panel unit root test is more effective than the IPS panel unit root test. In this research, we apply the Fisher PP panel unit root tests on our S&P 500 samples. The statistics from the Fisher PP for the levels of all variables reject the null hypothesis of a unit root with and without an intercept term and trend in each testing equation. Please see the detailed results in Table 2.

Table 2. Results of Fisher PP Chi-square panel unit root tests

Variables	Individual Intercept	Intercept&trend
MAR <sub>it</sub>	2044.97***	2014.13***
TAG <sub>it</sub>	1738.70***	1743.29***
DEPS <sub>it</sub>	2597.85***	2278.52***
LMBA <sub>it-1</sub>	851.05***	977.78***
LME <sub>it-1</sub>	656.17***	739.38***

Note:\*\*\* rejects  $H_0$ : Unit Root at 1% level of significance.

#### 4.2 Results of Panel Least Square Regression

Before applying the PSTR model to analyze our dataset, we have to recognize whether the unstable coefficients occur in our samples. Table 3 and table 4 present the results of panel least square regression with individual fixed effect among three size-grouped portfolios and five industry-grouped portfolios. From these two tables, we observe that all coefficients were statistically significant but nonlinear among three size-grouped portfolios and five industry-grouped portfolios. These empirical findings not only suggest that PSTR model should be a useful model than other models but also support this research to utilize the firm size that is proxy by the log-transformed 1-year lagged market equity as a transition variable.

Table 3. Panel least square regression with individual fixed effect among different size-grouped portfolios

Groups	Size1		Size2		Size3		ALL	
	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
TAG	0.20	0.00	0.28	0.00	0.27	0.00	0.25	0.00
DEPS	0.01	0.00	0.03	0.00	0.02	0.00	0.02	0.00
LMBA_1	-0.18	0.00	-0.28	0.00	-0.34	0.00	-0.25	0.00
C	0.06	0.00	0.11	0.00	0.13	0.00	0.10	0.00

Table 4. Panel least square regression with individual fixed effect among different industry-grouped portfolios

Groups	Industry1		Industry2		Industry3		Industry4		Industry5	
	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.	Coef.	Prob.
TAG	0.23	0.00	0.18	0.00	0.40	0.00	0.18	0.01	0.30	0.00
DEPS	0.01	0.00	0.02	0.00	0.01	0.00	0.04	0.00	0.04	0.00
LMBA_1	-0.26	0.00	-0.27	0.00	-0.41	0.00	-0.10	0.01	-0.23	0.00
C	0.17	0.00	0.04	0.00	0.17	0.00	0.12	0.00	0.08	0.00

#### 4.3 Panel Smooth Transition Regression Model

In order to recognize the determinants of the annual market-adjusted stock returns in this research, we execute the panel data techniques that enable us to verify the temporal evolution of individual groups rather than analyzing their temporal behavior. By using this approach, we believe that individual heterogeneity enables a large number of data to improve the efficiency of the estimates.

##### 4.3.1 Homogeneity test

According to the assumption that the macroeconomic effects on  $MAR_{it}$  have no difference among firms, we subjected the model to the LM test for homogeneity of the coefficients of  $DEPS_{it}$ ,  $TAG_{it}$ , and  $LMBA_{it-1}$ . Table 5 presents the homogeneity test result of the three regressors on  $MAR_{it}$  in our sample portfolio. It is clear that homogeneity was rejected at the 1% significance level for the three regressors on  $MAR_{it}$  when  $m=1$  and  $m=2$ . Based on this result, we assert that the coefficients of three regressors should be nonlinear.

Table 5. Results of homogeneity tests

H <sub>0</sub> : Linear Model against H <sub>1</sub> : PSTR model with at least one Threshold Variable r=1				
Statistics	m=1		m=2	
Wald Tests (LM)	20.952***	(0.000)	20.978***	(0.002)
Fisher Tests (LMF)	6.447***	(0.000)	3.223***	(0.004)
LRT Tests (LRT)	21.038***	(0.000)	21.064***	(0.000)

Note: Probability values are in parentheses. \*\*\* stands for 1% significant level.

#### 4.3.2 Parameter Constancy Test

An alternative way to test parameter constancy is the possibility that the parameter in Eq. (3) changed smoothly over time. The model accounting for this alternative way is called the time varying panel smooth transition regression (TV-PSTR) model. Table 6 shows the consequence of the parameter constancy test determining the hypothesis of no remaining heterogeneity. Due to the null hypothesis for  $r = 1$  is not rejected at the 1% significance level for  $m = 1$  and  $m = 2$ , we guarantee that there is no remaining heterogeneity when  $m = 1$  and  $m = 2$ .

Table 6. Results of no remaining heterogeneity tests

H <sub>0</sub> : PSTR with $r = 1$ against H <sub>1</sub> : PSTR with at least $r = 2$				
Statistics	m=1		m=2	
Wald Tests (LM)	0.959	(0.811)	11.031*	(0.087)
Fisher Tests (LMF)	0.292	(0.831)	1.684	(0.121)
LRT Tests (LRT)	0.959	(0.811)	11.055*	(0.087)

Note: Probability values are in parentheses. \* stands for 10% significant level.

#### 4.3.3 Determining the Number of Regimes

In this section, we conducted a sequence of tests to determine the order  $m$  of the transition function. We estimated the following PSTR model:

$$MAR_{it} = \mu_i + \beta'_0(DEPS_{it} + TAG_{it} + LMBA_{it-1}) + \sum_{j=1}^r \beta'_j g(LME_{it-1}^j; \gamma_j, c_j)(DEPS_{it} + TAG_{it} + LMBA_{it-1}) + \varepsilon_{it} \quad (5)$$

The tests of parameter constancy and no remaining heterogeneity were generalized to serve as misspecification tests in an additive PSTR model, expressed in Eq. (5) for any value of  $r$ . The outcomes of table 7 show that two criteria, the Akaike information criterion (AIC) and Schwartz's Bayesian information criterion (BIC), pointed out that  $m = 1$ ,  $r = 1$  with smaller BIC was an optimal combination on our PSTR model for the parsimony.

Table 7. Determination of number of regimes

Statistics	m=1	m=2
No. of Threshold r(m)	1(1)	1(2)
RSS	152.51	152.09
AIC	-2.8139	-2.8155
BIC	-2.7957	-2.7950

#### 4.3.4 Parameter Estimate

From the result of table 8, we learn that the contemporaneous change in EPS and the asset growth rate positively relate to the market-adjusted stock returns in both regimes at the 1% significant level. The coefficients of  $LMBA_{it-1}$  are negative at 1% significant in both value and growth regime. Most importantly, table 9 suggests that, in the value regime, a dollar increase in change of EPS causes an incremental 28.40% on annual market adjusted returns but only 16.84% in the growth regime. In addition, a 1% increase in the total asset growth is associated with an incremental market-adjusted stock returns ranging from 0.0228% in the value regime and 0.0122% in the growth regime. For the  $LMBA_{it-1}$  variable, a 1-unit increase in  $LMBA_{it-1}$  significantly affects the market-adjusted return to decrease by 21.40% in the value regime but 32.86% in the growth regime.

Table 8. Parameter estimation results of one-threshold PSTR model

Variables	Coefficient Estimate	SE of Heteroskedasticity	T-ststistics
$B_0 =$ DEPS <sub>it</sub>	0.2840***	0.0368	5.0968
TAG <sub>it</sub>	0.0228***	0.0038	7.0135
LMBA <sub>it-1</sub>	-0.2140***	0.0226	-2.9438
$B_1 =$ DEPS <sub>it</sub>	-0.1156*	0.0662	-3.3258
TAG <sub>it</sub>	-0.0106**	0.0053	-3.3392
LMBA <sub>it-1</sub>	-0.1146***	0.0370	-2.3254
[C]	<b>【9.8704】</b>	Exp(9.8704)=\$19,349.08M	
$\gamma$	0.9704		
RSS	152.51		
AIC	-2.8139		
BIC	-2.2957		

Note: \*\*, and \*\*\* stand for 5%, and 1% significant level.

Table 9. The marginal effects of regressors on market-adjusted stock returns

Variables	Value Regime	Growth Regime
TAG <sub>it</sub>	0.2840***	0.1684*
DEPS <sub>it</sub>	0.0228***	0.0122**
LMBA <sub>it-1</sub>	-0.2140***	-0.3286***

Note: \*\*, and \*\*\* stand for 5%, and 1% significant level.

Because of the negative coefficients of the three regressors in the second extreme regime in Table 8, it causes the positive marginal effects on contemporaneous change in EPS and total asset growth rate to decrease but makes the negative effects on the log-transformed 1-year lagged market to book ratio to increase in the growth regime in Table 9. Moreover, Table 8 points out that one threshold of log-transformed 1-year  $LME_{it-1}$  exists at 9.8704, approximately \$19,349.08M in market equity. This interesting and important finding implies an excellent indicator for firm managers to decide whether to exercise their investment opportunities. Specifically, Figure 1 depicts the scattered charts showing the logistic relationship between the transition function and the transition variable of  $LME_{it-1}$ . We can obviously tell that the coefficients changed smoothly from value to growth regimes.

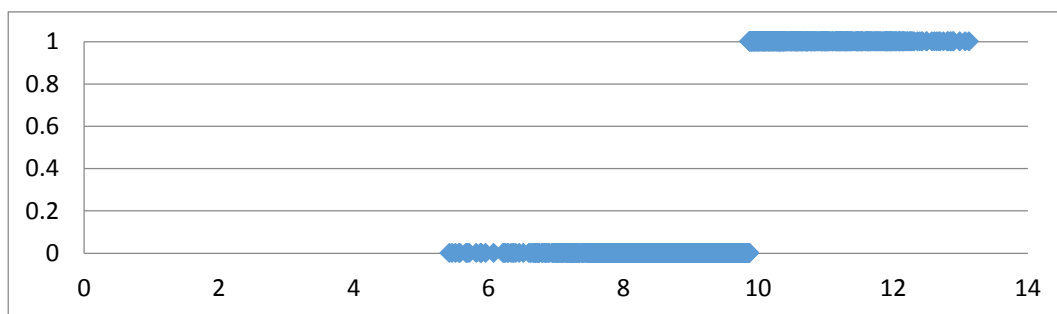


Figure 1. LMEit-1 nd transition function

#### 4.4 Interpreting the Results

Our previous empirical results show that one threshold exists and it can be used to divide whole sample into two groups, namely value stocks in the value regime and growth stocks in the growth regime. Table 10 presents the numbers, percentages, and market-adjusted returns on value stocks. From table 10, we observe that the number and percentage of all value stocks were 1,867 firm-year observations and 72.7%, respectively, which was approximately three fourths of the total observations. The average market-adjusted return of all value stock was 7.8%. The most important and interesting findings of this research is that 94.61% of the value stocks remain in the same regime and

their average market-adjusted returns are still lasting for several years from 7.3% to 7.27%. However, 5.39% of the valued stocks transit to growth stocks in the following years and the performance of these stocks decrease from 24.53% to -5.8%. On the other hand, table 11 shows that the number and percentage of all growth stocks were 701 and 27.3%, respectively, which was around one fourth of the total observations. The average market-adjusted return of all growth stock was -2.76%. There is another interesting finding on table 11 which shows 10.48% of growth stocks transit to value stocks in the following years and importantly, the market-adjusted returns of these stocks increase from -29.57% to 4.92%. Nevertheless, the performance of growth stocks that stay at the same place during our sample periods became worse from 0.79% to -1.48%.

Table 10. Numbers, percent, and market adjusted returns on value stocks over the years 2001-2012

Groups	All value stocks			Value-to-value stocks				Value-to-growth stocks			
	Year	Firms	%	MAR, %	Firms	%	MAR, % Value to Value	Firms	%	MAR, % Value to Growth	
2001	170	79.44	13.93	166	8.30	13.54		4	0.20	30.08	
2002	172	80.37	12.10	170	8.49	11.86	13.37	2	0.10	32.96	17.10
2003	176	82.24	5.49	167	8.34	4.82	5.42	9	0.45	17.93	11.99
2004	167	78.04	13.69	160	7.98	13.63	13.69	7	0.35	15.08	-6.20
2005	160	74.77	14.59	148	7.38	12.62	14.59	12	0.60	38.95	-0.11
2006	152	71.03	0.41	142	7.08	-0.52	0.56	10	0.50	13.64	-2.99
2007	142	66.36	8.56	127	6.33	5.38	8.56	15	0.75	35.46	-2.12
2008	133	62.15	3.84	132	6.57	3.37	3.40	1	0.05	66.51	-19.18
2009	165	77.10	9.28	148	7.37	8.52	8.96	17	0.85	15.88	-20.35
2010	148	69.16	6.23	137	6.82	4.82	6.23	11	0.55	23.80	0.21
2011	139	64.95	-0.70	134	6.66	-1.43	-0.73	5	0.25	18.92	-16.92
2012	143	66.82	2.62				2.75				-5.38
ALL	1867	72.70	7.80								
2001-2011	1724	73.24	8.23	1631	94.61	7.30		93	5.39	24.53	
2002-2012	1697	72.09	7.18			7.27					-5.80

Table 11. Numbers, percent, and market adjusted returns on growth stocks over the years 2001-2012

Groups	All growth stocks			Growth-to-growth stocks				Growth-to-value stocks			
	Year	Firms	%	MAR, %	Firms	%	MAR, % Growth to Growth	Firms	%	MAR, % Growth to Value	
2001	44	20.56	-12.66	38	1.90	-1.72		6	13.64	-81.92	
2002	42	19.63	-1.95	36	1.80	1.77	-3.95	6	14.29	-24.22	-22.96
2003	38	17.76	-1.58	38	1.90	-1.58	-2.34				7.46
2004	47	21.96	-3.97	47	2.35	-3.97	-3.44				
2005	54	25.23	-3.40	50	2.49	-1.45	-3.88	4	7.41	-27.72	
2006	62	28.97	-3.71	62	3.09	-3.71	-3.88				-5.00
2007	72	33.64	6.99	66	3.29	9.91	8.46	6	8.33	-25.12	
2008	81	37.85	-0.86	48	2.39	13.17	3.31	33	40.74	-21.26	13.23
2009	49	22.90	-9.36	49	2.44	-9.36	-9.14				10.56
2010	66	30.84	-1.38	64	3.18	-0.82	-1.93	2	3.03	-19.36	
2011	75	35.05	-1.18	66	3.28	3.39	1.52	9	12.00	-34.76	1.66
2012	71	33.18	-6.03				-6.08				0.70
ALL	701	27.30	-2.76								
2001-2011	630	13.46	-2.39	564	89.52	0.79		66	10.48	-29.57	
2002-2012	657	14.04	-2.09				-1.48				4.92



Table 12. Variable descriptive statistics on various value stocks over the years 2001-2012

Groups	All value stocks				Ante-value-to-value stocks				Post-value-to-value stocks				Ante-value-to-growth stocks				Post-value-to-growth stocks			
	Year	TAG,%	DEPS	MBA_1	ME_1	TAG,%	DEPS	MBA_1	ME_1	TAG,%	DEPS	MBA_1	ME_1	TAG,%	DEPS	MBA_1	ME_1	TAG,%	DEPS	MBA_1
2001	11.20	-0.06	1.93	5672	11.16	-0.07	1.95	5420					12.97	0.27	1.30	16113				
2002	8.28	-0.12	1.78	5684	7.81	-0.12	1.73	5538	8.73	-0.16	1.78	5469	48.16	0.19	5.97	18126	19.87	-0.08	1.36	21077
2003	11.04	0.22	1.43	5481	10.88	0.23	1.43	4894	11.10	0.26	1.45	5102	14.08	0.02	1.43	16392	22.08	0.15	3.01	20725
2004	10.88	0.63	1.65	6419	11.05	0.57	1.64	5963	10.88	0.63	1.65	6419	6.98	2.00	1.73	16849	9.40	0.59	1.87	25796
2005	13.09	0.37	1.72	7507	12.87	0.27	1.72	6841	13.09	0.37	1.72	7507	15.85	1.70	1.69	15720	4.51	1.53	1.84	21549
2006	11.01	0.28	1.83	8027	10.67	0.28	1.79	7420	11.28	0.28	1.83	7811	15.91	0.30	2.44	16642	20.26	1.15	1.99	24911
2007	11.53	0.21	1.74	8335	11.31	0.18	1.75	7480	11.53	0.21	1.74	8335	13.41	0.45	1.69	15574	9.47	0.36	2.53	21500
2008	4.65	-1.02	1.79	8454	4.53	-1.02	1.76	8377	5.16	-0.90	1.79	8036	20.78	-2.03	5.22	18628	9.17	0.53	2.04	22898
2009	6.13	0.05	1.16	7103	5.03	0.22	1.15	6016	6.06	0.24	1.21	5435	15.69	-1.38	1.20	16563	19.26	2.58	5.72	25381
2010	9.62	0.72	1.38	8049	8.98	0.71	1.36	7441	9.62	0.72	1.38	8049	17.63	0.84	1.68	15622	8.27	0.43	1.42	24912
2011	9.60	0.33	1.47	8953	9.50	0.32	1.48	8683	9.70	0.33	1.47	8826	12.35	0.63	1.13	16197	3.95	1.30	2.00	22667
2012	8.29	-0.01	1.37	9042					8.53	-0.17	1.39	8605					10.42	-0.02	1.52	22600
ALL	9.68	0.14	1.61	7289									15.24	0.35	1.74	16214				
2001-2011	9.79	0.16	1.62	7144	9.48	0.15	1.62	6626												
2002-2012	9.52	0.16	1.57	7451					9.75	0.18	1.59	7161					10.44	0.70	1.94	23413

Table 13. Variable descriptive statistics on various growth stocks over the years 2001-2012

Groups	All growth stocks				Ante-growth-to-growth stocks				Post-growth-to-growth stocks				Ante-growth-to-value stocks				Post-growth-to-value stocks			
	Year	TAG,%	DEPS	MBA_1	ME_1	TAG,%	DEPS	MBA_1	ME_1	TAG,%	DEPS	MBA_1	ME_1	TAG,%	DEPS	MBA_1	ME_1	DEPS	TAG,%	MBA_1
2001	12.62	-1.23	4.02	94624	15.68	-1.12	3.82	104881					-6.76	-1.92	5.35	29665				
2002	9.39	-0.55	2.54	87621	9.98	-0.63	2.67	97722	8.28	-0.60	2.67	94625	5.84	-0.04	1.79	27012	-4.23	1.06	1.71	11651
2003	9.64	1.64	2.00	72445	9.64	1.64	2.00	72445	8.95	1.72	1.94	75318					9.42	-1.07	1.09	16220
2004	6.62	0.11	2.12	76878	6.62	0.11	2.12	76878	5.96	-0.00	2.18	88977								
2005	3.51	0.73	1.98	72135	3.90	0.76	1.94	76255	3.37	0.61	2.00	79669	-1.28	0.42	2.42	20630				
2006	11.81	0.57	1.85	65591	11.81	0.57	1.85	65591	9.79	0.43	1.81	75354					1.11	0.32	1.89	16009
2007	9.26	0.15	1.91	67190	9.73	0.11	1.85	71258	9.22	0.11	1.81	74559	4.03	0.56	2.63	22436				
2008	1.64	-0.85	1.93	68414	0.01	-0.92	1.95	96631	-0.07	-1.16	1.90	78758	4.02	-0.76	1.89	27370	-6.26	-3.64	1.80	17312
2009	7.79	0.21	1.55	65313	7.79	0.21	1.55	65313	7.55	0.16	1.46	66145					6.40	-0.70	0.97	13772
2010	9.88	0.90	1.51	59271	10.05	0.93	1.51	60502	10.44	1.07	1.54	71191	4.51	0.01	1.57	19879				
2011	8.09	0.07	1.54	60973	8.59	0.32	1.52	66296	8.81	-0.15	1.46	67556	4.44	-1.76	1.66	21931	3.08	0.28	1.42	17665
2012	10.00	-0.16	1.43	65523					9.96	-0.17	1.42	68774					4.72	2.40	1.18	15555
ALL	8.13	0.10	1.95	69741																
2001-2011	7.92	0.13	2.01	70216	8.50	0.23	1.98	75423					2.96	-0.72	2.26	25720				
2002-2012	7.83	0.19	1.81	68074					7.40	0.11	1.79	75438					3.91	-0.33	1.22	14620

Additionally, table 12 and 13 brief the variable descriptive statistics for various value and growth stocks. Both tables indicate that the higher (lower) figures of  $TAG_{it}$  and  $DEPS_{it}$  result in ante-value-to-growth (ante-growth-to-value) stocks to transit into growth (value) stocks. In table 14, we present the marginal effects and individual influences from three regressors on value and growth stocks. It summarizes the differences from individual influence between value stocks and growth stocks were 1.38% in  $TAG_{it}$ , 0.21% in  $DEPS_{it}$ , and 11.8% in  $MBA_{it-1}$ .

Table 14. Marginal effects and individual impacts from three regressors on value and growth stocks over the years 2001-2012

Groups	All value stocks				All growth stocks				Differences			
Variables	TAG,%	DEPS	MBA_1	ME_1	TAG,%	DEPS	MBA_1	ME_1	△TAG,%	△DEPS	△MBA_1	△ME_1
2001	11.20	-0.06	1.93	5,672	12.62	-1.23	4.02	94,624	-1.42	1.17	-2.09	-88,952
2002	8.28	-0.12	1.78	5,684	9.39	-0.55	2.54	87,621	-1.11	0.43	-0.76	-81,936
2003	11.04	0.22	1.43	5,481	9.64	1.64	2.00	72,445	1.40	-1.42	-0.57	-66,963
2004	10.88	0.63	1.65	6,419	6.62	0.11	2.12	76,878	4.26	0.52	-0.47	-70,459
2005	13.09	0.37	1.72	7,507	3.51	0.73	1.98	72,135	9.58	-0.36	-0.26	-64,628
2006	11.01	0.28	1.83	8,027	11.81	0.57	1.85	65,591	-0.80	-0.28	-0.01	-57,565
2007	11.53	0.21	1.74	8,335	9.26	0.15	1.91	67,190	2.27	0.06	-0.17	-58,855
2008	4.65	-1.02	1.79	8,454	1.64	-0.85	1.93	68,414	3.00	-0.17	-0.14	-59,959
2009	6.13	0.05	1.16	7,103	7.79	0.21	1.55	65,313	-1.66	-0.16	-0.39	-58,211
2010	9.62	0.72	1.38	8,049	9.88	0.90	1.51	59,271	-0.26	-0.19	-0.13	-51,222
2011	9.60	0.33	1.47	8,953	8.09	0.07	1.54	60,973	1.51	0.26	-0.07	-52,019
2012	8.29	-0.01	1.37	9,042	10.00	-0.16	1.43	65,523	-1.71	0.15	-0.05	-56,480
ALL	9.68	0.14	1.61	7,289	8.13	0.10	1.95	69,741	1.55	0.04	-0.34	-62,451
Marginal effects	0.28	0.02	-0.21		0.17	0.01	-0.33		0.12	0.01	0.11	
Ind. Impacts, %	2.75	0.33	-10.13		1.37	0.12	-21.93		1.38	0.21	11.80	

Moreover, table 15 identifies the transitional behavior of all variables in our model among value and growth stocks and we note that the convergence of MBAit-1 ratios acts an important role to the transitional behavior. Specifically, the MBAit-1 ratios stay almost the same or increase as some value firms become more profitable or expand total assets but decrease as some growth firms do not continue profitable or contract total assets. Based on these empirical results, we conclude that individual impact from MBAit-1 certainly dominated the transitional behavior among value and growth stocks.

Table 15. Transitional behavior across value and growth stocks over the years 2001-2012

Transitional Behavior	MAR, %	TAG,%	DEPS	MBA_1	ME_1
Value to Value	7.30 to 7.27	9.48 to 9.75	0.15 to 0.18	1.62 to 1.59	6,626 to 7,161
Value to Growth	24.53 to -5.80	15.24 to 10.44	0.35 to 0.70	1.74 to 1.94	16,214 to 23,413
Growth to Growth	0.79 to -1.48	8.50 to 7.40	0.23 to 0.11	1.98 to 1.79	75,423 to 75,438
Growth to Value	-29.57 to 4.92	2.96 to 3.91	-0.72 to -0.33	2.26 to 1.22	25,720 to 14,620

In table 16, we especially extract 116 valued firms that significantly reveal the full-period and part-period sustainably profitable stocks over the sample period. We observe that the average market-adjusted returns of these stocks are 6.53% and 11.51% respectively.

Table 16. Numbers and variable averages of the full-period and part-period sustainably profitable stocks over the years 2001-2012

Year	Full-period sustainably profitable stocks						Part-period sustainably profitable stocks						All value stocks					
	Firms	MAR, %	TAG, %	DEPS	MBA_1	ME_1	Firms	MAR, %	TAG, %	DEPS	MBA_1	ME_1	Firms	MAR, %	TAG, %	DEPS	MBA_1	ME_1
2001	116	14.87	8.21	-0.06	1.86	4,128	54	11.90	17.62	-0.08	2.08	8,988	170	13.93	11.20	-0.06	1.93	5,672
2002	116	10.76	7.48	-0.05	1.68	4,149	56	14.89	9.93	-0.25	1.98	8,864	172	12.10	8.28	-0.12	1.78	5,684
2003	116	3.77	10.57	0.25	1.39	3,648	60	8.81	11.96	0.15	1.51	9,026	176	5.49	11.04	0.22	1.43	5,481
2004	116	12.25	9.32	0.49	1.56	4,719	51	16.97	14.44	0.95	1.84	10,285	167	13.69	10.88	0.63	1.65	6,419
2005	116	10.70	12.05	0.22	1.67	5,808	44	24.86	15.83	0.77	1.86	11,987	160	14.59	13.09	0.37	1.72	7,507
2006	116	-0.85	9.20	0.24	1.76	6,359	36	4.50	16.87	0.42	2.08	13,401	152	0.41	11.01	0.28	1.83	8,027
2007	116	4.81	11.92	0.16	1.72	6,996	26	25.30	9.81	0.43	1.84	14,306	142	8.56	11.53	0.21	1.74	8,335
2008	116	4.87	5.81	-0.67	1.77	7,482	17	-3.20	-3.29	-3.46	1.94	15,094	133	3.84	4.65	-1.02	1.79	8,454
2009	116	7.57	4.82	-0.14	1.22	4,900	49	13.33	9.21	0.51	1.02	12,317	165	9.28	6.13	0.05	1.16	7,103
2010	116	7.33	9.99	0.70	1.43	6,438	32	2.26	8.28	0.77	1.21	13,890	148	6.23	9.62	0.72	1.38	8,049
2011	116	-1.30	10.25	0.31	1.57	7,989	23	2.32	6.32	0.44	0.98	13,817	139	-0.70	9.60	0.33	1.47	8,953
2012	116	3.60	9.23	-0.07	1.46	7,918	27	-1.59	4.25	0.28	1.00	13,869	143	2.62	8.29	-0.01	1.37	9,042
ALL	1,392	6.53	9.07	0.12	1.59	5,878	475	11.51	11.45	0.23	1.65	11,424	1,867	7.80	9.68	0.14	1.61	7,289

Next, in table 17, we calculate the numbers and variable averages for the all sustainably profitable stocks over the sample years. It shows that the sustainably profitable market-adjusted stock returns are such strong in the first 5 years.

Table 17. Numbers and variable averages for the all sustainably profitable stocks over the years 2001-2012

Year	Sustainably profitable stocks					
	Firms	MAR, %	TAG, %	DEPS	MBA_1	ME_1
1st	236	11.41	9.16	-0.14	1.73	8,174
2nd	201	11.75	8.22	0.08	1.66	6,891
3rd	190	3.00	10.67	0.07	1.43	6,148
4th	182	12.79	9.48	0.71	1.57	6,886
5th	164	13.58	12.39	0.32	1.70	7,536
6th	150	1.26	11.07	0.32	1.82	7,802
7th	141	8.91	11.73	0.18	1.74	8,200
8th	124	5.12	6.00	-0.62	1.78	7,799
9th	124	8.52	6.77	-0.13	1.24	5,249
10th	121	8.11	10.02	0.71	1.43	6,743
11th	118	-1.34	10.90	0.29	1.55	8,119
12th	116	3.60	9.23	-0.07	1.46	7,918
ALL	1,867	7.80	9.68	0.14	1.61	7,289

## 5. Conclusion

The main purpose of this research is to identify the possibility of the sustainably profitable stocks. In order to test this idea, we initially recognize the transitional behavior among value and growth stocks based on a balanced panel dataset composed of 214 firms from S&P 500 during 2001-2012. By applying a nonlinear PSTR model, we confirm that three transitional determinants among value and growth stocks. Specifically, the log-transformed 1-year lagged market to book asset ratio ( $LMBA_{t-1}$ ) was negatively related to market-adjusted stock return, while the

contemporaneous total asset growth rate ( $TAG_t$ ) and the change in EPS ( $DEPS_t$ ) positively correlated with market-adjusted stock return.

Next, this study investigates the threshold effect of the log-transformed 1-year lagged market equity value on market-adjusted stock return by using a nonlinear PSTR model. The results show that one threshold exists and it can be used to divide whole sample into two groups, namely value stocks in the value regime and growth stocks in the growth regime. Based on our empirical results, the higher annual average market-adjusted returns for value stocks contributed to contemporaneously higher positive marginal effects from change in profitability and total asset growth but a lower negative impact from the log-transformed 1-year lagged market to book asset ratio.

Based on the empirical evidence in this study, we understand that three transitional determinants, namely the change in EPS, total asset growth rate, and the log-transformed 1-year lagged LMBA ratio, are critical among value and growth stocks. Moreover, the most important and fascinating finding on this research is that 94.61% of the value stocks remain in the same regime over the sample period and their average market-adjusted returns are still lasting for twelve years from 7.3% to 7.27%. More specific, we verify 116 value firms that significantly reveal the full-period sustainably profitable stocks over the sample period and the average market-adjusted return of these is 6.53%.

The uniqueness of our study is to apply a nonlinear panel smooth transition regression (PSTR) model in examining the possibility of sustainably profitable stocks. In particular, the implication for academic is that PSTR model not only provides a parametric approach to the firm-specific heterogeneity and the time-specific instability of the slope coefficients, but also allows the parameters to change smoothly as a function of the transition variable ( $q_{it}$ ). Additionally, the implication for industry is that we can make profit by buying the stocks with the one-year lagged market equity value less than threshold value at the beginning of the year and selling them by the end of the year. Consequently, this interesting finding may provide rich implications for institutional investors to design profitable and effective investment strategies.

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